UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/544,291	08/04/2005	Herbert Bruder	32860-000908/US	9190

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EXAMINER
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ART UNIT	PAPER NUMBER
2882	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)
	10/544,291	BRUDER ET AL.
	Examiner	Art Unit	
	ALEXANDER H. TANINGCO	2882	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS,
WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed
  after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any
  earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>14 April 2008</u>.

2a)☒ This action is FINAL.   2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is
closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) <u>1-17</u> is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) <u>1-17</u> is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☒ All b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☒ Copies of the certified copies of the priority documents have been received in this National Stage
application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)
2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3)☐ Information Disclosure Statement(s) (PTO/SB/08)
    Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____.
5)☐ Notice of Informal Patent Application
6)☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 2-4, 7, 8, 10-13, 16, and 17 are rejected under 35 U.S.C. 103(a) as

being unpatentable over Hu et al. (US 5,430,783) in view of Ning (US 6,477,221) and in

further view of Besson et al. (US 6,459,754).

With regards to claims 1 and 16, Hu et al. disclose a method for generating

images in computed tomography using 3D image reconstruction (Col. 2 Lines 9-11), the

method comprising: scanning an examination object **42** by moving a focus on a spiral

focal track about the examination object using a conical beam (Abs. Line 3) emanating

from the focus and using a planar detector for detecting the beam (Col. 8 Line 22; Col.

12 Line 36), the detector supplying output data corresponding to the detected radiation

(Col. 8 Lines 25-30); and reconstructing image voxels from the scanned examination

object from the output data and reproducing attenuation coefficients of the respective

voxel (Col. 13 Lines 15-16), each image voxel reconstructed that include a projection

angular range of at least 180° (Col. 5 Line 60-61); whereby a measured value filtered for

each image voxel is accumulated only on the respective voxel (Col. 5 Line 68), and an

approximate weighting taking place for each voxel considered in order to normalize the

projection data used relating to the respective voxel (Col. 6 Line 1). Hu et al. fail to

explicitly teach a method further comprising: each image voxel being reconstructed

separately from projection data. Ning teaches a method comprising: all voxels and

projections are independent of one another, and rays can be backprojected of each

projection are independent (Col. 8 Lines 8-10). Besson et al. teach a method

comprising: each image voxel being reconstructed separately from projection data (Col.

1 Lines 65-67; Col. 6 Line 64). It would have been obvious to one of ordinary skill in the

art, at the time of invention to modify the invention of Hu et al. to include the features of

Ning and Besson et al. to improve computational speed as taught by Ning (Col. 3 Lines

41-44).

With regards to claim 2, Hu et al. as modified above teach a method wherein

reconstructing an image voxel, using all the detector data along a straight line that runs

through the cone beam projection of the image voxel and is aligned in the direction of

the projection of the spiral tangent (Fig. 5).

With regards to claim 3, Hu et al. as modified above teach a method wherein

the image data of the detector image are subjected to a cosine weighting **88** for

compensating oblique radiation (Col. 12 Equation 4).

With regards to claim 4, Hu et al. as modified above teach a method wherein

data not directly available are obtained from the available data by interpolation from

neighboring detector data (Col. 5 Lines 8-17).

With regards to claim 7, Hu et al. as modified above teach a method wherein a

ramp filter that is manipulated with the aid of a smoothing window is applied to the

normalized data (Col. 5 Line 56) in view of Ning.

With regards to claim 8, Hu et al. as modified above teach a method wherein a distance weighting is performed for the purpose of 3D back projection into the voxel considered (Col. 12 Equation 2).

Regarding claim 10, Hu et al. as modified above disclosed an apparatus comprising: a beam emanating from at least one focus **26** and a detector array **44** having a multiplicity of distributed detector elements for detecting the rays of the beam, the at least one focus being movable β relative to the examination object **42** on at least one focal track that runs around the examination object and a detector array situated opposite; means for collecting detector data **84**, filtering **89** and 3D back projection **90**; and means for processing the collected data **60** being fashioned in such a way to carry out the method as claimed in claim 1 (Fig. 1; Fig. 4).

Regarding claim 11, Hu et al. as modified above disclose a method computer program **60** product including program elements that during operation in a CT unit, execute the method as claimed in 1 (Fig.1; Fig. 4).

Regarding claim 12, Hu et al. as modified above disclose a method wherein the image data of the detector image are subjected to a cosine weighting **88** for compensating oblique radiation (Col. 12 Equation 4).

Regarding claim 13, Hu et al. as modified above disclose a method wherein data not directly available are obtained from the available data by interpolation from neighboring detector data (Col. 11 Lines 1-2).

Regarding claim 17, Hu et al. as modified above disclose a method wherein the projection angular range is a range from at least 180° to less than 360° (Col. 17 Line 24).

Claims 5 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hu et al. (US 5,430,783), Ning (US 6,477,221), and Besson et al. (US 6,459,754) as applied to claims 1 and 2 above, and further in view of Lai (US 6,118,841).

Regarding claims 5 and 14, Hu et al. as modified above disclose a method of the above claim. Hu as modified above fail to teach a method wherein during a weighting for compensating a data redundancy, measuring beams (Sa, Sb) are regarded as redundant precisely when holding that: ($\theta a = (2k \cdot \pi + \theta b$ and $pa = pb$) or ($\theta a = (2k + 1) \cdot \pi + \theta b$ and $pa = - pb$). Lai teaches a method wherein during the weighting for compensating the data redundancy, measuring beams (Sa, Sb) are regarded as redundant precisely when it holds that: ($\theta a = (2k \cdot \pi + \theta b$ and $pa = pb$) or ($\theta a = (2k + 1) \cdot \pi + \theta b$ and $pa = - pb$) [Col. 7 Lines 9-10, 21-22]. Lai teaches a standard symmetric array (Abs.) and the angular span of the beam (Col. 7 Lines 9-10). It would have been obvious to one of ordinary skill in the art, at the time of invention to modify the invention of Hu to include a method of Lai wherein during the weighting for compensating the data redundancy, measuring beams (Sa, Sb) are regarded as redundant precisely when it holds that: ($\theta a = (2k \cdot \pi + \theta b$ and $pa = pb$) or ($\theta a = (2k + 1) \cdot \pi + \theta b$ and $pa = - pb$), for accurate reconstruction (Col. 7 Line 3).

Claims 6 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hu et al. (US 5,430,783), Ning (US 6,477,221), Besson et al. (US 6,459,754), and Lai

(US 6,118,841) as applied to claims 5 and 14 above, and in further view of Silver et al.

(US 2003/0123614).

   With regards to claims 6 and 15, Hu et al. as modified above disclose a

method as recited above in claims 5 and 14. Hue et al. as modified above fail to

explicitly teach a method wherein the redundant data are multiplied by generalized

Parker weights. Silver et al. teach a method wherein the redundant data are multiplied

by generalized Parker weights [0017 Equations 1-5]. It would have been obvious to one

of ordinary skill in the art, at the time of invention to modify the invention of Hu et al. as

modified above to include the features of Silver et al to improve imaging and reduce

artifacts as taught by Silver et al. [0017 Lines 1-2].

   Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hu et al.

(US 5,430,783), Ning (US 6,477,221), and Besson et al. (US 6,459,754) as applied to

claim 1 above, and in further view of Gullberg et al. (IEEE Vol. 11, no. 1, June 1992).

   Regarding claim 9, Hu et al. as modified above disclose a method as recited in

claim 1 above. Hu et al. as modified above fail to teach a method wherein the method

is used for cardiac computer tomography by at least one of selecting, weighting and

sorting measured data in accordance with the movement phases of an examined heart.

Gullberg discloses a method wherein the method is used for cardiac computer

tomography by at least one of selecting, weighting and sorting the measured data in

accordance with the movement phases of an examined heart (Pg.91 Para. 5). It would

have been obvious to one of ordinary skill in the art, at the time of invention to modify

the invention of Hu to include a method of Gullberg wherein the method is used for

cardiac computer tomography by at least one of selecting, weighting and sorting the measured data in accordance with the movement phases of an examined heart, for better diagnosis of ischemic heart disease as taught by Gullberg (Pg. 91 Para. 1 and Pg. 99 Para. 5).

Response to Arguments

Applicant's arguments filed 04/14/2008 have been fully considered but they are not persuasive.

Applicant asserts that prior art fails to describe "an approximate weighting taking place for each voxel." The examiner respectfully disagrees.

Hu et al. (US 5,430,783), known hereinafter as "Hu", discloses some voxels being scanned more than once for a given angle and this extra data is weighted (Abs.). The extra data is weighted and used during the backprojection process on a voxel by voxel basis (Col. 5 Line 67 – Col. 6 Line 5). Hu discloses a weighting factor as a function of the spatial coordinates of a voxel and of a beam angle (Col. 16 Lines 34-37). Hu further discloses after weighting and filtering, a projection set of the projections are backprojected to voxels (Col. 13 Lines 10-15) and the backprojection produces attenuation or density values for voxels of the image defined by the center of a voxel. During this backprojection process, the existence of extra data is accounted for by weighting the intensity signals associated with the rays of the projection with a weight factor (Col. 13 Lines 15-50). Hu is considered to meet the limitation of "weighting taking place for each voxel."

Ning (US 6,477,221), known hereinafter as "Ning", discloses reconstructed voxel values are indexed by physical coordinates x, y, and z (45-50). Ning discloses let a reconstruction volume be N_x x N_y x N_z voxels in the x, y, and z directions (Col. 6 Lines 14-15). It can be recognized that a N x N x N voxel in the x, y, and z direction is a separate reconstruction of an individual voxel. Ning further discloses in a reconstruction process, all voxels and projections are independent of one another, and rays can be backprojected independently (Col. 8 Lines 9-10).

Besson et al. (US 6,459,754), known hereinafter as "Besson", discloses each voxel reconstruction volume, it is necessary to compute for each source position, a ray passing from a source through a voxel (Col. 1 Line 65 – Col. 2 Line 5). Besson discloses a voxel-driven backprojection (Col. 3 Line 50) and for each view in a reconstruction volume, a ray passing from a source through each voxel is computed (Col. 3 Lines 50-55). Besson discloses a reconstruction algorithm (equation 8) and a half-scan weighted algorithm (equation 9) as a function of a voxel and reconstruction of a voxel (Col 6 Line 60 – Col. 7 Line 30). Besson discloses different weights depending on samples per voxel (Col. 8 Lines 50-67). Besson further discloses a voxel-dependent geometric weight factor (Col. 7 Line 64 - Col. 8 Line 30).

With regards to applicant's arguments against the combination of Hu, Ning, and Besson, applicant's arguments are not persuasive.

Hu and Besson disclose a weighting taking place for each voxel. In particular, Hu and Besson disclose a weighting based on an amount of samples per voxel. Ning disclose each image voxel being reconstructed separately. One of ordinary skill in the

art would appreciate a method of reconstructing a voxel separately as taught by Ning and incorporate it in any system to improve computations in reconstruction as taught by Ning (Col. 4 Lines 60-65).

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

For the above reasons, applicant's arguments are not persuasive and the rejections have been maintained.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The following patents are cited to further show:

Proksa et al. (US 6,285,733) shows determining the radiation source positions whose measuring data are to be taken into account for the reconstruction of the absorption in individual voxels includes reconstructing the absorption of voxels with an irradiation angle (Col. 2 Lines 46-50)

Navab (US 6,049,582) shows accumulating contributions corresponding to a plurality of image projections so as to thereby reconstruct each voxel (Abs.)

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ALEXANDER H. TANINGCO whose telephone number is (571)272-8048. The examiner can normally be reached on Mon-Fri 8:00-4:30 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ed Glick can be reached on (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the

Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR.

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you have questions on access to the Private PAIR system, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a

USPTO Customer Service Representative or access to the automated information

system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Alexander H Taningco/
Examiner, Art Unit 2882

/Chih-Cheng Glen Kao/
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